इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 15208 (2002): Unidirectional Non-Woven Semi-Cured Glass Fibre Tape [ETD 2: Solid Electrical Insulating Materials and Insulation Systems]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

भारतीय मानक

एकदिशीय गैर-बुने अर्ध-अभिसाधित काँच के रेशों के टेप — विशिष्टि

Indian Standard

UNIDIRECTIONAL NON-WOVEN SEMI-CURED GLASS FIBRE TAPE — SPECIFICATION

ICS 29.035.20

© BIS 2002

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 2002

Price Group 4

Solid Electrical Insulating Materials Sectional Committee, ET 02

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Solid Electrical Insulating Materials Sectional Committee had been approved by the Electrotechnical Division Council.

This standard covers the requirements for unidirectional non-woven glass fibre tape consisting of parallel twisted glass yarn.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

UNIDIRECTIONAL NON-WOVEN SEMI-CURED GLASS FIBRE TAPE — SPECIFICATION

1 SCOPE

This standard covers the requirements for unidirectional non-woven glass fabric tape consisting of parallel twisted glass yarns. The glass yarns used shall be continuous glass fibres (usually known as E glass, containing not more than one percent of alkali calculated as sodium oxide and shall be impregnated with catalyzed thermosetting synthetic resins like acrylic/ polyester, etc, meeting desired thermal class for specific application and semi-cured to a suitable stage to ensure desired flow characteristics during applications like bandaging of armature of electrical machines, transformers coils, etc, to retain windings/ assemblies in position.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
196 : 1966	Atmospheric conditions for testing (*revised*)
1271 : 1985	Thermal evaluation and classification of electrical insulation (*first revision*)
1570 (Part2/Sec 1): 1979	Schedules for wrought steels: Part 2 Carbon steels (unalloyed steels), Section 1 Wrought products (other than wire) with specified chemical composition and related properties (*first revision*)
1954 : 1990	Determination of length and width of fabrics — Methods (*second revision*)
1998 : 1962	Methods of test for thermosetting synthetic resin bonded laminated sheets
5352 (Part 2) : 1999	Textiles — Glass and glass-polyester fibre woven tapes : Part 2 Methods of test (*third revision*)

3 GENERAL REQUIREMENTS

3.1 The tape shall be supplied in semi-cured stage in rolls in soft well balanced flat ribbon without any separation of yarns and distortion, ensuring that each yarn bears equal share of load after application. It should be easily unwoundable.

3.2 The size (dimensions), thermal classification of tape, type of resin and storage temperature shall be subject to agreement between the purchaser and the supplier, and shall be stated in the order.

4 CLASSIFICATION AND DESIGNATION

The tape shall be classified as per assigned temperature index into 155°C, 180°C, 200°C and 220°C class, established in accordance with IS 1271.

5 NATURE OF RESIN AND RELATED TAPE CHARACTERISTICS

5.1 Chemical Identification of Resin

Chemical composition of resin binder as determinal by infra-red spectrography and thin layer chromatography or any other suitable method shall be exactly same as agreed to between the purchaser and the supplier.

5.2 Curing of Resin After Application

The minimum curing time required to get good consolidation after applying on the job (object) shall be in accordance with Table 1. After curing, the surface shall be tack free and layers shall not get separated easily.

Table 1 Minimum Curing Time

(*Clause* 5.2)

Sl No.	Time h	Temperature °C
i)	2	160
ii)	3	150
iii)	4	130
iv)	14	120
v)	20	115

NOTE — The time necessary to bring the job (object) to temperature is not included.

5.3 Storage Life (Shelf Life)

The storage life depends upon storage temperature. For prolonged life, the tapes are stored in original container in cool dry storage areas. Optimization of chemical composition of synthetic resin and process must ensure that the material shall retain the properties prescribed in the standard during storage at different temperatures for period not less than given in Table 2 after the date of manufacturing which normally shall not be earlier than one month from the date of despatch to the purchaser.

Table 2 Shelf Life at Different Temperatures

(*Clause* 5.3)

Sl No.	Storage Temperature °C	Shelf Life Months
(1)	(2)	(3)
i)	10	18
ii)	15	12
iii)	20	8

6 DIMENSIONS AND TOLERANCES

6.1 The tapes shall be supplied in thickness, width and roll lengths as specified in the order.

6.2 Thickness

The preferred nominal thickness shall be 0.3 or 0.33 mm. Other thickness may be supplied as per agreement between the purchaser and the supplier. The thickness as measured by the method described in Annex A shall not differ from the nominal by more than ± 0.05 mm.

6.3 Width

The preferred nominal width of the tape shall be 10, 15, 20, 25, 30 and 40 mm. The width of the tape is determined in accordance with method prescribed in IS 1954 and shall not differ from nominal by more than:

a) ± 1.5mm for nominal widths up to and including 25 mm, and

b) ± 2 mm for nominal widths over 25 mm.

6.4 Length/Roll

Unless otherwise specified, the tape shall be supplied in continuous length of 200 m. The length of tape in each roll shall be determined by the method prescribed in IS 1954 and shall not differ from nominal length by more than $^{+2}_{-0}$ m.

7 OTHER REQUIREMENTS

The tapes shall conform to the requirements given in Table 3, when tested by the respective methods of test.

8 MARKING

8.1 Each roll of tape shall be legibly marked with the following information:

a) Manufacturer's/ supplier's name;

b) Type of tape/ designation/ trade-mark, if any;

c) Length of roll, in m;

d) Thickness and width of tapes, in mm; and

e) Date of manufacture.

8.2 Each transit pack (carton), containing number of rolls as agreed to between the purchaser and the supplier shall have the following information, clearly and indelibly marked on it:

a) Purchase order No. of purchaser;

b) Manufacturer/supplier's name;

c) Type of tape/ designation/ trade-mark, if any;

d) Length of roll, in m;

e) Thickness and width of tape, in m; and

f) Date of manufacture and shelf life expiry date under specified storage condition.

9 PACKING

9.1 The tape shall be wound on a hard tubular core with sufficient tension in anti-clockwise spiral to form a compact roll but without deforming the construction of tape. The internal diameter of core shall be not less than 10 mm and its width shall approximately be the same as the width of tape.

9.2 The individual rolls of material of the same thickness, width and length shall be separately packed to ensure that these can be early separated and are protected from moisture, dust, direct sun light and damage during transit.

Table 3 Requirements of Unidirectional, Non-woven Semi-cured Glass Fibre Tape

(*Clause* 7)

Sl No. (1)	Tape Condition (2)	Test Nature (3)	Characteristics (4)	Requirements (5)	Test Methods (6)
i)	As supplied	Routine	Warp yarns (ends/cm width)	30 ± 1	IS 5352 (Part 2)
			Resin content percent, *Min*	27 ± 3	Annex B
			Tensile strength N/mm, *Min*	200.0	Annex C
			Sealing (Solder) test	Should pass	Annex D
			Curing test	Should pass	Annex E
		Type	Loss in weight percent, *Max*	10	Annex F
ii)	Cured tape	Type	Resistance to boiling water	Should pass	Annex G
			Resistance to saline water	Should pass	Annex H
			Breaking load after curing, N/mm, *Min*:		Annex J
			a) At room temperature	265.00	
			b) At the thermal class temperature	185.00	
			Cross breaking strength, N/mm^2, *Min*:		Annex K
			a) At room temperature	900.00	
			b) At room temperature after boiling in water for 14 days	50 percent of value at room temperature, *Min*	

ANNEX A

(*Clause* 6.2)

METHOD OF TEST FOR MEASUREMENT OF TAPE THICKNESS

A-1 TEST APPLIANCE

Micrometer having accuracy of 0.01mm.

A-2 TEST PIECES

Take 5 rolls of tape selected at random.

A-3 CONDITIONING

Condition the tape rolls to moisture equilibrium in atmosphere of relative humidity of 65 ± 2 percent with temperature of 27 ± 2 °C (*see* IS 196) before testing.

A-4 TEST PROCEDURE

Pressure exerted when measuring thickness be of order of 10 N/cm^2. From each roll measure the thickness of tape every 300 mm. Take 10 measurements.

A-5 RESULT

Take the average of ten measurements on each roll. Take the central value of five individual results as thickness of tape.

ANNEX B

(*Table* 3)

RESIN CONTENT

B-1 TEST SPECIMEN

Three pieces of 1m length each cut from the roll at random.

B-2 CONDITIONING

Condition the test pieces in an air oven at 55°C for one hour.

B-3 TEST PROCEDURE

Weigh the specimen in porcelain/ceramic dish/crucible (P_1). Heat it in an oven at a temperature of 600 ± 25°C for 2 h. Cool the crucible in a desiccator and weigh after it has returned to room temperature to determine the weight of residue (P_2):

Result:

$$\text{Resin content percent} = \frac{P_1 - P_2}{P_2}$$

The arithmetical mean of the values is obtained.

ANNEX C

(*Table* 3)

TENSILE STRENGTH OF TAPE IN SUPPLY CONDITION

C-1 TEST PIECE

The test is carried out on a 30 mm wide tape. For wider tapes, burn the tape and count out 30 glass threads and separate this part of the tape from the remaining part, so that the test may be carried out on a 30 mm wide tape.

Cut the tape first into five 400 mm long test pieces and the remaining tape length into small, 20-50 mm long pieces. Stretch out carefully the 400 mm long tapes on a horizontal plane. Place the small pieces crosswise, under and over the tape ends at a distance of 300 mm (*see* Fig. 1).

Insert the overlapping ends between two sheet copper pieces and cure the resin for 3-5 min by means of an iron heated at a temperature of 200 - 250°C.

This procedure will produce a test specimen to be fixed between the clamps of tensile testing machine, with a uniform effort being exerted on the glass yarn.

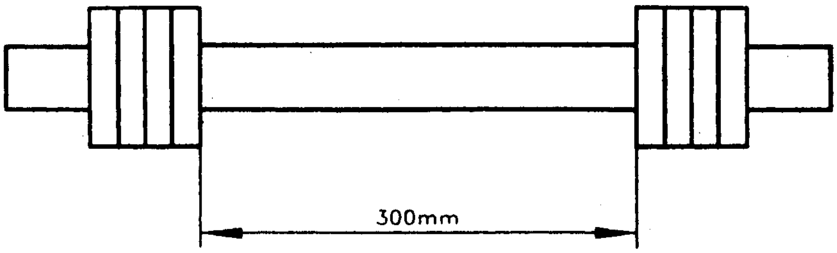

FIG. 1 TEST PIECE

C-2 TEST PROCEDURE

Fit the test specimen carefully between the clamps of a tensile testing machine and determine the breaking stress by applying a force which increases gradually without sudden stresses in such a way that breaking occurs after about approximately 30 s.

C-3 RESULT

Tensile strength is expressed in N/mm. The tensile strength of the tape is the average value of the 5 measurements.

ANNEX D

(*Table* 3)

SEALING (SOLDER) TEST

D-1 TEST PIECE

A roll of the tape.

D-2 PROCEDURE

A solder iron at 160 ± 2°C pressed on the top layer of the roll. The resin of the tape should flow and stick to other layers within one minute.

ANNEX E

(*Table* 3)

CURING TEST

E-1 TEST PIECE

A machined steel mandrel of diameter at least 50 mm and length minimum 150 mm.

E-2 PROCEDURE

Six layers of tape shall be wrapped tightly on the steel mandrel, the tape end being maintained under tension till the band end is sealed with a heat gun. The taped mandrel shall be cured at 150°C for three hours. After cooling the mandrel to room temperature, the cured tape has to be checked for consolidation. Surface should be tack free and layers should not get separated easily.

ANNEX F

(*Table* 3)

MEASUREMENT OF LOSS IN WEIGHT

F-1 TEST SPECIMEN

Three 1 m long test pieces are cut from one roll at random.

F-2 TEST PROCEDURE

Weigh (P_1) the specimen in porcelain/ceramic dish/ crucible. Heat it in an oven temperature higher than the thermal class by 20°C for 400 h ± 30 min. Cool the crucible in desiccator and weigh (P_2) after it has returned to room temperature.

F-3 RESULT

$$\text{Weight loss, percent} = \frac{P_1 - P_2}{P_1}$$

The arithmetic mean of the 3 values is obtained.

ANNEX G

(*Table* 3)

BOILING WATER RESISTANCE TEST

G-1 PROCEDURE

Two split discs are bonded with six layers of tape and cured as described in Annex J. One sample is partially and the other fully immersed in boiling water for 120 h. After the test, the band shall be examined visually. There should not be any sign of cracks, damages or any defects on the bands.

ANNEX H

(*Table* 3)

SALINE WATER RESISTANCE TEST

H-1 PROCEDURE

Two split discs are banded with three layers of tape and cured as described in Annex J. The samples shall be kept in two separate plastic bags containing 3 percent sodium chloride solution by weight. The bags shall be kept at 50 ± 2°C for 10 weeks. After the above test, there shall not be any sign of cracks, damages or any defects on the band.

ANNEX J

(*Table* 3)

BREAKING LOAD AFTER CURING

J-1 TEST PIECE

A pair of split disc rings made of 40 C8 steel [*see* IS 1570 (Part 2/Sec 1)] of 125 mm diameter and having a circumferential groove of 3 mm depth and 25 mm width are banded with six turns of tape. The initial and final turns shall have extra half turn (overlap) so that full six turns are available for breaking load test. The fixture is shown in Fig. 2. The two clamps (*A*) are provided to hold the split discs in position. The tape is laid in the groove in a smooth, flat manner such that the centre line of tape coincides with centre line of groove *A* tension of 100 N/mm width consistent through out the banding operation is applied to the tape. The tape end is maintained under tension till the band end is sealed with a heat gun.

The bands are cured for 3 h at 150°C. Remove the clamps (*A*) after specimen attains room temperature.

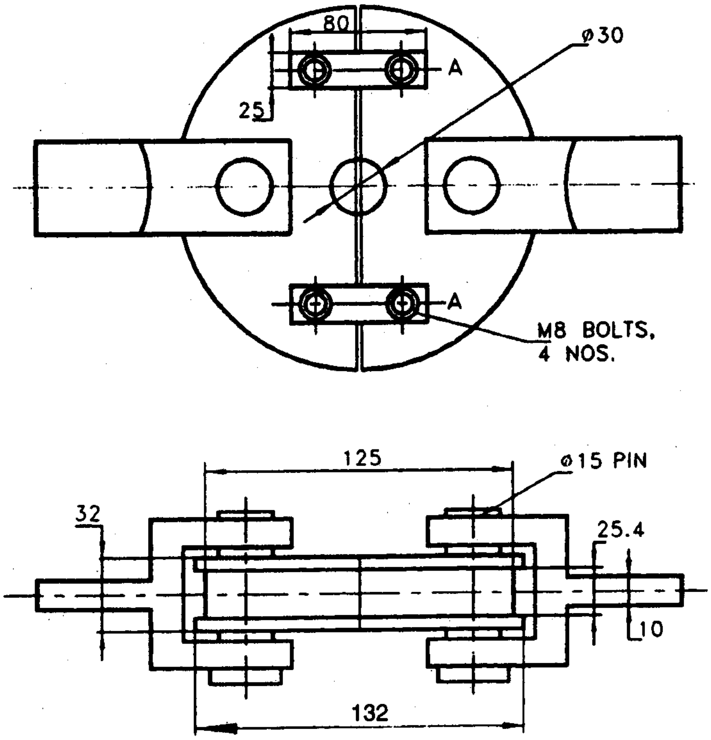

FIG. 2 FIXTURES FOR DETERMINING THE BURSTING FORCE OF BANDING TAPE

J-2 DETERMINATION OF BREAKING LOAD

J-2.1 At Room Temperature

J-2.1.1 The cured bands are subjected to tensile load in a tensile testing machine at room temperature. The breaking load of 6 layer of tape (F) is recorded.

J-2.2 Breaking Load at Thermal Class Temperature

J-2.2.1 The cured test specimens are heated in oven at temperature which is higher than the thermal class temperature by 20°C for about 2 h. At the end of the two hours, the specimen is removed from the oven and subjected to tensile test when the temperature of the specimen has attained the thermal class level. The breaking load of the tape is recorded.

Result :

The breaking load of tapes (P) is calculated as:

$$P = \frac{F}{2 \times T \times B}$$

where

P = breaking load in N/mm width of tape;
F = average breaking load;
T = number of turns of tape; and
B = width of tape, in mm.

Average of two measurements will be recorded as breaking load in N/mm width of tape. It must be ensured that each of the values is more than minimum acceptable value.

ANNEX K

(*Table* 3)

MEASUREMENT OF CROSS BREAKING STRENGTH

K-1 Fifteen layers of tape are pressed at 3 N/mm^2 at 155 ± 5°C for 3 h to prepare 4 mm thick laminate and cross breaking load (*see* IS 1998) is measured at room temperature. Mean of the 3 measurements is taken as the cross breaking strength. Similar measurements are made after immersing the test pieces for 14 days in boiling water.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. ET 02 (5104).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	323 76 17 323 38 41
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700 054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022	60 38 43 60 20 25
Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600 113	254 12 16, 254 14 42 254 25 19, 254 13 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.

Printed at New India Printing Press, Khurja, India